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Recent Developments in the History of Science and Christianity

Nancy Pearcey

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A Discussion With Nancy Pearcey

Recent Developments in the History of Science and Christianity

by Nancy Pearcey

It is a common metaphor that science and religion are at "war" with one another—that since the dawn of modernity, religion has opposed scientific advance while science has undermined religion. Recently, this metaphor was brought home to me in a dramatic way. I was doing research while sitting outside my son's karate class, and one of the other mothers asked what I was working on. When I said the relationship between science and religion, her eyebrows shot up in surprise, and she said, "Why? Aren't they always in conflict? I mean, don't religion and science disagree about everything?"

The intensity of her reaction took me by surprise. But it was a vivid reminder that we moderns all grow up with the stereotype of "warfare" between science and religion.

To be fair, that stereotype is deliberately cultivated in some quarters. In *Darwin's Dangerous Idea*,[1] Tufts philosophy professor Daniel Dennett argues that Darwinism destroys the basis for theistic religion. His trademark metaphor is that Darwinism is a "universal acid" that dissolves away all traditional moral and religious beliefs. He even suggests that traditional religious groups be put in "cultural zoos," along with other things that have gone extinct.

What Dennett is promoting is not science but "scientism"—the idea that only science has the truth, the whole truth, and nothing but the truth: everything else is subjective opinion. This is the dominant worldview in academia today (despite protests by postmodernists and others), going by such names as positivism, naturalism, or scientific materialism. Already half a century ago, G. K. Chesterton warned that scientism had become a "creed" taking over all our institutions. He called it a "system of thought which began with Evolution and has ended in Eugenics," and he added that "[m]aterialism is really our established Church."[2]

Nancy Pearcey is Senior Fellow at the Discovery Institute's Center for the Renewal of Science and Culture. Her works on the history of science include co-authoring (with Charles B. Thaxton) The Soul of Science *(Wheaton: Crossway Books, 1994) and (with Charles Colson)* How NOW Shall We Live? *(Wheaton: Tyndale House Publishers, 1999).*

In constructing a Christian perspective on the sciences, an initial task for scholars is to clear the ground by mounting an effective critique of this "established Church." Christians need to point out that scientism is a merging of science with philosophical naturalism. We also need to offer a viable alternative: a biblically based philosophy of science.

Christian Themes in the History of Science

In constructing a biblical philosophy of science, an excellent place to begin is by consulting the church's own history and heritage. Among historians today, there is a strong conviction that a philosophy of science should be based on actual scientific practice, not on idealized, *a priori* prescriptions of how science "ought" to be practiced. In practice, until roughly the late nineteenth century, most scientists in America worked within a public framework shaped in large part by Christianity (whatever their private beliefs may have been). Contrary to the "warfare" stereotype, Christianity provided many of the key philosophical assumptions about nature and epistemology that motivated and under-girded the scientific enterprise.

The positive contribution of Christianity to modern science is now acknowledged by most historians, including those who have no religious belief themselves. After all, modern science developed in a thoroughly Christian context—in medieval Europe, a culture steeped in biblical faith. Most of the key figures in the scientific revolution were believing Christians, and for a good three centuries, science and religion not only coexisted peacefully but actually were seen as mutually confirming. Today it has become an accepted area of inquiry in the history of science to probe the precise ways in which Christianity provided the motivations and philosophical assumptions that made modern science possible.

This inquiry is a relatively new development, and it is helpful to place its emergence within a broader context. In the 1960s, the history of science as a discipline underwent a shift from a positivist to an idealist methodology. In the positivistic approach, historians tended merely to chronicle scientific discoveries—picking out whatever agreed with modern scientific orthodoxy and rejecting the rest as irrationality and superstition. By contrast, in the idealistic approach, historians seek to understand historical figures holistically and contextually—showing how scientists were influenced by religious beliefs, socio-economic context, political interests, and so on. As a result, historians now acknowledge that science is often shaped by extra-scientific factors—such as religion, philosophy, and even magic and mysticism. Consider a few titles that have come out over the past few years:

- *A History of Magic and Experimental Science* (Columbia University Press)
- *Occult and Scientific Mentalities in the Renaissance* (Cambridge University Press)
- *Reason, Experiment, and Mysticism in the Scientific Revolution* (Macmillan)
- *Religion, Science, and Worldview* (Cambridge University Press)[3]

Note that most of these books were published by respected academic presses. The titles alone give clear evidence of a dramatic shift in the focus of scholarship on the history of science.

This change in perspective has not been easy for historians. In 1990 a book appeared titled *Reappraisals of the Scientific Revolution*, arguing in favor of the new approach. In 2000, a decade later, another book appeared titled ***Rethinking*** *the Scientific Revolution*, edited by Margaret Osler, who complained that many historians are still stuck in their old positivistic ways. Many have made only minor adjustments to the new approach, Osler charged, and they continue to judge historical figures by modern standards instead of understanding them within their historical context—a practice that Osler disparaged as putting "old wine in new bottles."[4]

More importantly, the Christian world remains largely unaware of these new developments. A few hints have filtered down to the popular level. The influential evangelist Francis Schaeffer used to cite quotations from Robert Oppenheimer and Alfred North Whitehead. The Whitehead quotation is particularly well known: the idea that every detailed occurrence follows a general law, he said, came "from the medieval insistence on the rationality of God, conceived as with the personal energy of Jehovah and with the rationality of a Greek philosopher."[5]

Another widely repeated quotation, appearing

frequently in books on popular science, is by Loren Eiseley. In *Darwin's Century*, he says, "In one of those strange permutations of which history yields occasional rare examples, it is the Christian world which finally gave birth in a clear, articulate fashion to the experimental method of science itself."[6]

More recently, physicist Paul Davies has said, "In Renaissance Europe, the justification for what we today call the scientific approach to inquiry was the belief in a rational God whose created order could be discerned from a careful study of nature."[7]

Among Reformed scholars, no doubt many are familiar with the 1972 book by R. Hooykaas, *Religion and the Rise of Modern Science*, as well as the 1977 book by Eugene Klaaren, *Religious Origins of Modern Science*.[8]

These themes are dealt with in greater detail in my book, *The Soul of Science*, and I won't repeat what I said there. Instead, I'd like to draw attention to some of the more recent literature that has appeared since *Soul of Science* was published in 1994. I hope to convey some of the excitement of this rich new vein of research that has opened up on the relationship between science and Christianity. My approach is primarily descriptive, and I will organize my presentation around a few key works that have come out in recent years.

Back to the Middle Ages

A consistent trend in current history of science is to push the origin of science ever further back into the medieval period. The middle ages are no longer denigrated as a time of superstition and irrationality. Instead, contemporary historians tend to express respect for medieval philosophy and theology as the matrix from which early modern science emerged.

An example is *Before Science: The Invention of the Friars' Natural Philosophy*, by Roger French and Andrew Cunningham.[9] The authors focus on two religious orders—the Dominicans and the Franciscans—that played an important role in the study of nature in thirteenth-century Europe. The book points out that "while the friars have been, in a general way, included in the stories told by historians of 'medieval science,' no one to our knowledge has hitherto looked at the *basis* of the friars' interest in nature: why they were interested in nature at all" (2). The answer to that question, the authors argue, is that the friars were not interested in "science" in anything like the modern sense of the term. Instead, their interest in nature was spurred by thoroughly religious motivations.

The Dominicans arose at a time when the most powerful threat to orthodoxy came from the heresy of the Cathars (which included the Albigensians). The Cathars taught that the material world is evil, and that there must therefore be two gods—one good and the other evil. The Dominicans took on the task of developing an apologetic against this Manichean-style heresy, and thus they focused their arguments on two principles: first, there is only one God, and second, nature is good. The second principle proved highly influential in justifying interest in, and study of, the natural world.

Contrary to the "warfare" stereotype, Christianity provided many of the assumptions that made modern science possible.

A key step was redefining the term "nature." Until then, it had been used mostly in the sense of essences—the "nature of things." Now the term became tied more directly to physical creation, God's good handiwork. As French and Cunningham put it, "The Dominicans found a very simple way of proving that the material world was good: 'Nature' was equated with 'creation'" (140).

To advance the argument that nature is good, the Dominicans could not simply appeal to Scripture ("And God saw that it was good"), because the Cathars rejected much of Scripture. However, they respected the philosophy of Aristotle, whose works were just becoming available. Thus, to support their case, the Dominicans sought ways they could appeal to Aristotle as an authority that the Cathars would accept: "Aristotle held that in general natural change—the operation of [the four] causes—was *good*, first in that the Potentiality of matter was being fulfilled by the Actuality of Form

in the process of informing" (141, 190). Thus Albert Magnus, the teacher of Thomas Aquinas, argued that "the natural world was good and was evidence of the work of a single good Creator, and should therefore be studied" (183).

The central point that French and Cunningham are making here is that the new interest in nature arose out of a specifically religious need—the need to frame an apologetic against the Cathar heresy: "Nature was to be studied, discussed, disputed about and even observed and investigated, not primarily for itself nor for the sake of disinterested knowledge but for what it said about God its creator" (202). Over against the Cathars' teaching that the material world is evil, the Dominicans' "message was that God is good, His creation is good, the goodness and the causality of the Creation are evidence of the goodness of God" (202). In accounts of medieval "science," the Dominicans are often credited with bringing about a renewed interest in nature, but it is often overlooked that their motivation was not scientific but religious.

The authors make a similar point regarding the Franciscans. The main inspiration for the Franciscans was the mystic Dionysius, who taught a neo-Platonic concept of emanations. For the Franciscans, light became a symbol of divine emanation (223, 230): "Spiritual Light is what God is, and which acts on the level of the intelligible. Visible light is what He uses to carry out His purposes in the sensible world. Study of visible light therefore tells one most directly about God and His actions" (224).

This belief accounts for "why certain Franciscans chose, out of all the possible things in nature, to study and investigate light above all" (224)—and why they focused much of their attention on what we call "optics" (231). The Franciscans also pioneered a mathematical approach to science—which, at the time, meant primarily a geometrical approach—because light travels in straight lines. Interestingly, by contrast, a Christian Aristotelian did *not* see the universe as constructed geometrically (237). Thus, a typical text on the history of science will include many Franciscans under the heading of "the development of optics": e.g., Robert Grossteste, Roger Bacon, John Pecham, and others (232, 235).

Does the work done by these two religious orders mean that the thirteenth century witnessed the rise of science in the modern sense? Many historians suggest that what we see at this stage is the early development of modern "objective" science within a religious matrix. But French and Cunningham argue that this conclusion reads modern concepts of science back into the past. For friars of both orders, science and religion were inseparable—one and the same thing. The Dominicans' interest in nature was motivated by apologetics: for them, sensible, created things were evidence of the Creator and His goodness. The Franciscans, on the other hand, were motivated by the desire for mystical experience: sensible things were stepping-stones to mystical experience with the Creator (224). But in both cases, interest in nature did not stem from a desire to study physical phenomena for their own sake, nor to exert technological control; rather, that interest was one aspect of a broader religious program.

The Literal Truth

Two fascinating books that have appeared recently treat the impact of theories of language on the scientific revolution. The first is by Peter Harrison, titled *The Bible, Protestantism, and the Rise of Natural Science*.[10] Harrison offers an account of the religious roots of the change from a medieval worldview to a modern worldview. For the medieval mind, the physical world was overlaid with multiple layers of moral, spiritual, and allegorical meanings. Scholars have called this the "emblematic" or "hieroglyphic" worldview, because it conceived nature as a collection of poetic images to be probed for moral and spiritual meaning.[11]

The best-known example is Conrad Gesner's *History of Animals* in the 1500s. Take Gesner's entry on "peacock": there we read the bird's name in several different languages; a collection of what ancient authors such as Aristotle and Pliny said about it; a list of the peacock's habits; several legends, e.g., that its flesh does not decay after death; and a statement that it is thus a symbol of immortality. We learn that the peacock is associated with the goddess Juno and appears in pictures with Juno on coins; we encounter peacock proverbs, fables, and even recipes. In other words,

in the emblematic worldview, the important form of knowledge is not physiological description and taxonomic classification; what's important is a complex web of associations that links the peacock with history, culture, mythology, morality, and religion.

To give another example, in 1512 Albrecht Dürer designed a large triumphal arch for emperor Maximilian I, and on top Dürer put several symbolic animals: a lion (representing fear), a dog wearing a stole (representing the judgment of kings), a crane on raised foot (a guard against enemies), a bull (courage with temperance), and others. "In other words, animals were part of a visual language; they were symbols. . . . Animals were living characters in the language of the Creator, and the naturalist who did not appreciate or understand this had failed to comprehend the pattern of the natural world."[12] Nature was compared to a book—the book of God's works—and the important thing to understand was not causation but "signification" (17). Think of it as the Proverbs approach to nature: "Go to the ant, O sluggard!" The importance of nature was that it taught spiritual and moral lessons.

How was this symbolic, metaphorical view of nature exchanged for the modern scientific one—where things are stripped of all the mythical, moral, and spiritual meanings and seen simply as phenomena within a causal nexus? Several scholars have sought to answer this question, since William Ashworth raised it in a provocative essay in 1990.[13] But Harrison offers what may be the most convincing solution. The ultimate source of both the medieval and the modern worldviews, he suggests, was Christian theology—or more precisely, hermeneutics. And the transition from one to the other was a consequence of the Reformation.

Harrison points out that the medieval view of nature parallels the medieval method of Scripture interpretation. The metaphor of nature as a book, written "by the finger of God," as Hugh of St. Victor put it (44), implied that "the world, like scripture, was a locus of divine revelation" and could be "read" by the same methods. Thus, the hermeneutical method developed by the church fathers for reading Scripture provided interpretative strategies for dealing with objects in the physical world as well (15).

What was that hermeneutical method? The church fathers, followed by medieval theologians, distinguished among four senses of Scripture. The historical sense was foundational, logically speaking, but it was also of least interest to medieval exegetes (30-31, 32). Of much greater interest were the three "spiritual" senses: the allegorical, the tropological (or moral), and the anagogical (or eschatological). In other words, the historical events recounted in Scripture constituted a visual language, a symbol system that spoke of invisible realities (akin to Dürer's animals). Allegory and symbolism were more than literary techniques employed by an author; instead allegorical and symbolic meanings were realities inhering in things and events themselves.

The Reformers' literal historical hermeneutic in theology opened the way for a literal hermeneutic of nature.

This hermeneutical strategy for reading the book of God's Word, Harrison argues, also shaped the hermeneutical strategy for reading the book of God's works—namely, the symbolic interpretation of the medieval world. If he is right, then the reason for the decline of that symbolic interpretation is clear: it was caused by the Protestant Reformation. The Reformers championed a literal, historical hermeneutic in theology, which opened the way for a literal hermeneutic in interpreting nature. In the literal approach, things "were denied signifying powers." They no longer stood for other things; only words could stand for things (114-115).

By discrediting the symbolic view of nature, the literal hermeneutic opened the way for a modern scientific view. Natural processes ceased to be regarded as images or symbols of spiritual realities, and instead were regarded as actual, physical mechanisms (152). Many of the early modern scientists claimed explicitly that they were reading nature in a literal fashion, without medieval gloss-

es and interpretations. They claimed that they were rejecting medieval philosophy not for another philosophy but for a straightforward description of nature.

An example is Galileo, who is discussed in another recent book entitled *The Word of God and the Languages of Man: Interpreting Nature in Early Modern Science and Medicine*, by James Bono.[14] Bono points out that Galileo did not argue the merits of his own philosophy compared with scholastic or other traditional philosophies; instead, he argued that what he offered was not philosophy at all. It was simply a literal reading of nature. Galileo claimed that he was sweeping away the accumulated verbiage of the past in order to uncover the true language of nature.

In his well-known metaphor, nature is a book "written in the language of mathematics, and its characters are triangles, circles, and other geometric figures" (194). Galileo conceived this language as literal, not symbolic or poetic: "As a book, nature . . . contains no ambiguities, no hidden and symbolic meanings, no fables or poetic senses to obscure the truth . . ." (197). Instead, its language is the sharp, distinctly etched forms of geometric figures. Thus, the scientist's task is simply to read that literal text, which God has inscribed in nature, in a literal way. "He need not seek below the literal surface of the geometrical characters inscribed in nature for some deeper, hidden meaning" (197); "Galileo figures nature as an 'open' text that he can read directly, without the need for interpretation" (195).

But of course, as Bono argues, Galileo was not merely describing nature apart from any philosophy, despite his claim. His approach was as much a product of a philosophy as the scholastics' was: he was applying the Reformers' ideal of literal interpretation to nature. He had not escaped from narratives; he had merely substituted one narrative for another (274).

From Metaphor to History

Before moving on, I want to give a little more attention to Harrison's book, because it raises several additional points of interest to Christians. The new literal hermeneutic caused Christians to look at the early chapters of Genesis in a new way—with a new interest in what really happened. The creation, the fall, the flood, the tower of Babel all began to be regarded not primarily as allegorical or symbolic accounts but as real cosmology. This shift had several consequences.

First, it inspired people to try to identify physical mechanisms for events in Scripture. There was intense speculation on the geographical location of the Garden of Eden, heaven, purgatory, and hell. (Harrison cites extensively from original source materials on each of these points, which I can summarize only briefly.) Many early scientists proposed various biological mechanisms to account for the resurrection. Others (e.g., Thomas Burnet, William Whiston, John Woodward, Nicholas Steno) began to suggest physical mechanisms for the flood (here we see the beginnings of modern flood geology). Many of the same thinkers also proposed natural forces to explain the end of the earth, when it would be destroyed by fire.

The Protestant interest in historicity also opened the way for the Reformed understanding of Creation, Fall, and Redemption. The church fathers had interpreted Adam's dominion over the animals as a metaphor for the dominion of reason over the passions (209). They had interpreted the command to "be fruitful and multiply" to mean the cultivation of the virtues and the "fruits" of the spirit. Thus, redemption was strictly personal and internal—it was defined as regaining mastery over the passions and developing the virtues. Augustine interpreted the paradise to be restored strictly as a paradise within (209).

But if Genesis was historical, an account of real events, then the command to have dominion meant the mastery of nature, not of the passions. And if the Fall was likewise an event within history, then it made sense to conceive of redemption as reversing the Fall within history, at least in part. It began to seem possible to recover dominion over nature, by scientific knowledge and industry, and thereby to reverse the process of deterioration set in train by the Fall and to improve the human condition (59, 230). Finally, just as the Garden become an historical reality, so did the millennium: Hope began to be expressed that by subduing the earth, it might be possible to create a new Eden, and we see the beginnings of millennialism.

With the focus on Genesis as history, another

incident came to have enormous significance: Adam's naming of the animals. This event was interpreted to mean that Adam had access to the creative Word by which God had made the world—a language that expressed the essence of each thing named. The implication was that in the state of original innocence, Adam had been in possession of vast, encyclopedic knowledge of the natural world. And if redemption means the recovery of our original state, then one aspect of redemption would include the recovery of Adam's perfect knowledge. Thus, science was justified as an attempt to recover or reconstruct Adam's original knowledge of creation, which would also provide the means of dominion over nature (61-62 and passim). To quote Martin Luther, "We are now again beginning to have the knowledge of the creatures which we lost in Adam's fall. Now we observe the creatures rightly, more than popery does."[15] Luther can't resist making a polemical point, but notice how science was justified as the recovery of Adamic knowledge.

The naming of the animals also led to an effort to recover or reconstruct Adam's original language—an Ur language that would be universal and would express essential truths. Though it was eventually concluded that the original Adamic language had been irretrievably lost (probably at the tower of Babel), nonetheless the story inspired the search for a single, universal language of science—which was declared by Galileo, Descartes, and others to be mathematics (262). The search for a mathematical language unifying all the sciences was thus inspired in part by the Genesis account.

From Theology to Science

Finally, I would like to draw attention to a book by Margaret Osler, entitled *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World.*[16] The debate over whether the order in the world is necessary or contingent has played an enormous role in the history of science. In the middle ages, the question of necessity was raised by the threat of various forms of philosophical determinism.

In Neo-Platonism, the concept of emanation implied an inner necessity within God that required Him to create a plentitude of beings of all types—the Great Chain of Being. In his classic book on the subject, Arthur Lovejoy says that these ideas were applied to the Christian God most consistently in the twelfth century by Peter of Abelard, who realized that it led to a "necessitarian optimism"—that is, the idea that this must be the best possible world, and that God could not have made it otherwise. Nothing is contingent; everything must be precisely what it is.[17] Abelard's ideas were condemned, but Neo-Platonic determinism continued to exert a strong influence.

With the recovery of Aristotle's writings, a new form of determinism loomed, for those writings arrived via Muslim philosophers such as Avicenna and Averroes, who denied both the providence of God and the free will of humans. The Aristotelian form is an immanent cause, which was taken to mean that order emerged by necessity from the "nature of things." Some Christian Aristotelians argued that even God could not change the nature of things: it was argued, for example, that God could not create a vacuum, and that the "nature" of the heavens required circular motion for the planets.

The basic categories of seventeenth-century science were translations of late medieval theological debates.

This concept of necessity seemed an insult to God's freedom and omnipotence. In reaction, it inspired what has come to be called voluntarist theology, which stressed the contingency of the world on God's will. In 1277 the Bishop of Paris condemned a list of propositions drawn from Aristotelianism, particularly propositions stating what God could not do (e.g., create a vacuum). Theologians began to draw a distinction between God's "absolute" power and His "ordained" power (*potentia absoluta* and *potentia ordinata*). His absolute power is what God can do hypothetically. In an absolute sense, His power is not bound by anything except the law of contradiction. For example, He could have created a world different

from the one He actually created. Thus, this particular world is contingent on His will.

Contingency, however, does not mean chaos. Having created a particular order, God chooses to respect that order and work within it. This is His ordained power—His power working within the order He has established. Thus, the order of nature does not emerge by necessity from causes immanent in things; instead, it is a contingent order imposed externally on things by God's will.

The concept of contingency was developed by the nominalist philosophers, especially William of Ockham, who would greatly influence the Reformers. It is significant that the concept of contingent order was often spoken of using a legal metaphor: God is a king who lays down laws for his kingdom. In fact, the most common word was "covenant." The order in nature was covenantal, contingent on God's will and promise. Francis Oakley, in his book *Omnipotence, Covenant, and Order*, explains it this way: although God cannot be bound by any of His creations, He can freely choose to bind himself "to follow a stable pattern in dealing with his creation in general and with man in particular. If God has freely chosen the established order, he has so chosen, and while he can dispense with or act apart from the laws he has decreed, he has nonetheless bound himself by his promise and will remain faithful to the covenant that, of his kindness and mercy, he has instituted with man."[18]

As Oakley's words suggest, this understanding of nature allowed for miracles, for the order in nature was not necessary but contingent moment by moment on God's will. Thus, He could also change that order, if He willed to do so.

What did these debates over necessity and contingency mean for science? As Western thinkers turned their interest from theology to nature, these concepts were translated into a philosophy of science. As Osler writes, "In the seventeenth century, these ideas about God's relationship to the creation were transformed into views about the metaphysical and epistemological status of human knowledge and the laws of nature" (10-11).

The concept of necessity found expression in the view that the laws of nature describe the essences of things. Epistemologically, this view meant that at least some things could be known *a priori*, and that this knowledge would be certain, or demonstrative. This view led to various forms of determinism, and Osler gives examples from the thinking of Rene Descartes.

By contrast, the concept of contingency found expression in the view that the laws of nature are merely observed regularities. Epistemologically, this view meant that those laws could be known only empirically, and that knowledge is merely probabilistic. The example Osler gives here is Pierre Gassendi. Interestingly, both Descartes and Gassendi embraced a voluntarist theology and a mechanistic philosophy of nature. However, Descartes retained some elements of necessity from his Thomistic education, and thus we find elements of determinism in his philosophy, along with innate ideas known *a priori*. By contrast, Gassendi limited science to what can be known empirically. He "redefined the goal of natural philosophy, replacing the traditional search for demonstrative knowledge of real essences with probable knowledge of the appearances" (110).

Numerous historians and philosophers have dealt with the impact of voluntarism and nominalism on the rise of empirical science, but Osler's new book gives the most thorough and detailed discussion yet. She makes clear that the basic categories of scientific thought in the seventeenth century were translations of the theological debates in the late middle ages.

Whither Science?

What do these historical developments mean for us today? How can Christians in general benefit from knowing more about the history of science?

First, it remains useful for apologetics purposes. The hostility of a secular world is still often expressed, among other ways, in criticizing Christians for being historically reactionary, superstitious, obscurantist, anti-scientific—in short, enemies of free thought. In *Before Science*, French and Cunningham say positivist historians have "presented the *history* of science as the story of the defeat, over time, of superstition by rationality"—the defeat of religion and bigotry by science (273-4, emphasis in original). This misleading image persists in many quarters today.

Even the new contextual approach to science has not completely overcome that error. Though

there is greater appreciation for the religious and theological context in which scientific thought grew and developed, many historians of science continue to conceive of science as separable from that religious matrix. What is overlooked, argue French and Cunningham, is that the practitioners of natural philosophy "were concerned with studying nature *as created by God*," and their motivation was to understand and worship God better. Natural philosophy was not merely an early version of science, albeit within a religious context; rather, it was a different enterprise altogether with its own character, which must be understood on its own terms (3-4, emphasis in original).

A second benefit of studying the history of science is that it provides a wealth of material for developing a theology of creation. Alister McGrath has published a new book called *A Scientific Theology*,[19] in which he sets forth a theology of creation, reviewing some of the same points discussed in this paper and in *The Soul of Science*. Certainly, any theology of creation ought to draw on the rich historical dialogue that has been carried on by Christians over the centuries.

Third, understanding the history of Christian reflection on nature offers an effective handle on understanding Western intellectual history in general. Until the nineteenth century, the majority of thinkers were Christians of some variety, and most scientific discourse took place within a public intellectual framework shaped at least originally by theological concepts (as Osler, for instance, has shown). Thus, a better grasp of our own history provides insight into Western intellectual history generally. In particular, given the central role that science plays in modern culture, understanding the history of science is crucial if Christians are going to interact intelligently in our world today.

Of course, many Christians are professionally active in the sciences as well, and for them a grasp of intellectual history is especially important. Most Christians working in the sciences have not thought through a biblical philosophy of science. Christians today are more likely than in the past to be highly educated in terms of technical expertise. But many do not have a Christian framework within which to interpret the subject matter of their field. An excellent strategy for developing a Christian worldview is to begin by immersing oneself in the writings of great thinkers who have wrestled over the centuries with questions such as God's relationship to the world, the character of the order of nature, and so on. Developing a Christian motivation, rationale, and conceptual framework for scientific work is crucial for obeying the cultural mandate—and for being renewed in our minds, rather than being conformed to the world.

Finally, if science arose from a matrix of Christian thought, what does that imply for the future of science in our own day? Does a biblical conception of nature remain a necessary underpinning for science today? Or does secular thought provide an adequate alternative basis for science?

If science arose from a matrix of Christian thought, can secular thought provide an adequate basis for science?

I began with a quotation from Whitehead stating that it was medieval Christianity that inspired faith in a regular order in nature. Whitehead goes on to suggest that today there is no rational basis for this faith, due to the rise of modern empiricism. "Since the time of Hume," he writes, "the fashionable scientific philosophy has been such as to deny the rationality of science." As a result, he says, scientists today maintain a "scientific faith" in the order of nature while lacking any rational basis for it.[20] He does not tell us whether he thinks a "scientific faith" can survive sans such a rational justification.

Others take a more aggressive stance, arguing that alternatives to Christianity, such as materialism and Darwinism, are not capable of supporting an adequate epistemology for science—or for any truth claims, for that matter. In *Warrant and Proper Function*, Alvin Plantinga argues that "what evolution guarantees (at most) is that we behave in certain ways—in such ways as to promote survival. . . . It does not guarantee mostly true or verisimilitudinous beliefs." Natural selection preserves behavior that promotes survival; whether or not that behavior is based on true

beliefs is irrelevant.[21]

British philosopher Roger Trigg makes a similar argument in *Philosophy Matters*. He writes that for evolution, "it does not matter if a belief is true or false, as long as it is useful, from a genetic point of view." Thus, "evolutionary epistemology . . . is much more inclined to talk of causes rather than reasons."[22]

Plantinga and Trigg are both theists, yet other philosophers who are decidedly hostile to theism confirm their arguments. Philosopher Patricia Churchland agrees that in evolutionary theory survival wins out over truth. She writes that the human mind has evolved because "improvements in sensorimotor control confer an evolutionary advantage: a fancier style of representing is advantageous *so long as it is geared to the organism's way of life and enhances the organism's chances of survival.* Truth, whatever that is, definitely takes the hindmost."[23]

Similarly, the well-known deconstructionist Richard Rorty insists that ideas should be treated merely as problem-solving tools that help us get ahead in the struggle for existence. In a *New Republic* article, he wrote that "Keeping faith with Darwin" (note the terminology) means understanding that the human species is not oriented "toward Truth" but only "toward its own increased prosperity."[24]

Interestingly, Darwin himself wrestled with the question of truth as well—not just once, but several times. In one typical example he wrote, "With me, the horrid doubt always arises whether the convictions of man's mind, which has been developed from the mind of the lower animals, are of any value or at all trustworthy." What's significant is that Darwin always expressed this "horrid doubt" in the context of admitting that he could not quite shake an "inward conviction" that the universe cannot be the result of chance after all, but requires an intelligent Mind, a First cause. In other words, he applied his skepticism selectively: when his mind led to a theistic conclusion, he argued that after all the human mind cannot give us any real truth.[25]

But, of course, Darwin's own theory was also a product of the human mind, and therefore he was cutting off the branch he himself was sitting on. In short, Darwinian naturalism is self-refuting. Plantinga and Trigg both make this argument, and Trigg expands it into a general indictment of all forms of materialism: if all beliefs are caused by natural mechanisms, this undercuts belief in the truth of any belief, including belief in materialism itself. Trigg quotes the British geneticist J.B.S. Haldane, who said, "I am not myself a materialist, because, if materialism is true, it seems to me that we cannot know that it is true. If my opinions are the result of chemical processes going on in my brain, they are determined by the laws of chemistry, not those of logic."[26]

Thus, I would like to end with a few words of Alvin Plantinga, taken from a review of *Darwin's Dangerous Idea*, mentioned at the beginning of this paper. Plantinga concludes his review by saying, "Modern science was conceived, and born, and flourished in the matrix of Christian theism. Only liberal doses of self-deception and doublethink, I believe, will permit it to flourish in the context of Darwinian naturalism."[27] Those are strong words, but I suspect Plantinga is right. To make the case would require another paper, however, so I will stop here by suggesting that it is at least an open question whether science can survive and thrive on any philosophical basis other than the one provided historically by Christianity.

ENDNOTES

1. Daniel Dennett, *Darwin's Dangerous Idea* (New York: Simon and Schuster, 1995), p. 520.
2. G.K. Chesterton, *Eugenics and Other Evils* (New York: Dodd, Mead, 1927), p. 98.
3. Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols. (New York: Columbia University Press 1923-1958); Brian Vickers, ed., *Occult and Scientific Mentalities in the Renaissance* (Cambridge: Cambridge University Press, 1984); J. L. Righini Bonelli and William R. Shea, eds., *Reason, Experiment, and Mysticism in the Scientific Revolution* (New York: Macmillan, 1975); Margaret J. Osler and Paul Lawrence Barber, eds., *Religion, Science, and Worldview* (Cambridge: Cambridge University Press, 1985).
4. David C. Lindberg and Robert S. Westman, eds., *Reappraisals of the Scientific Revolution* (Cambridge: Cambridge University Press, 2000). Margaret Osler, ed., *Rethinking the Scientific Revolution* (Cambridge: Cambridge University Press, 2000), pp. 19-20, n. 53.

5. Alfred North Whitehead, *Science and the Modern World* (Toronto: Macmillan, Free Press, 1925), p. 12.
6. Loren Eiseley, *Darwin's Century* (Garden City, New York: Doubleday, 1958; Doubleday Anchor Books, 1961), p. 62.
7. Paul Davies, *The Mind of God* (New York: Simon & Schuster, 1992), p. 77.
8. R. Hooykaas, *Religion and the Rise of Modern Science* (Grand Rapids: Eerdmans, 1972); Eugene M. Klaaren, *Religious Origins of Modern Science* (Grand Rapids: Eerdmans, 1977).
9. Roger French and Andrew Cunningham, *Before Science: The Invention of the Friars' Natural Philosophy* (Hants, England: Scolar Press, 1996). Numbers in parentheses refer to page numbers for this work.
10. Peter Harrison, *The Bible, Protestantism, and the Rise of Natural Science* (Cambridge: Cambridge University Press, 1998). Numbers in parentheses refer to page numbers for this work.
11. A seminal work on this subject is William B. Ashworth, Jr., "Natural History and the Emblematic Worldview," in *Reappraisals*, pp. 303-333.
12. Both these examples are from Ashworth, pp. 306-307.
13. See note #11.
14. James J. Bono, *The Word of God and the Languages of Man: Interpreting Nature in Early Modern Science and Medicine* (Madison: University of Wisconsin Press, 1995).
15. Cited in Bono, p. 71. Bono deals extensively with the theme of Adam's naming the animals and the search for a universal language.
16. Margaret Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (Cambridge: Cambridge University Press, 1994).
17. Arthur Lovejoy, *The Great Chain of Being* (Cambridge: Harvard University Press, 1936, 1964), pp. 70-71.
18. Francis Oakley, *Omnipotence, Covenant, and Order* (Ithaca: Cornell University Press, 1984), p. 62.
19. Alister McGrath, *A Scientific Theology* (Grand Rapids: Eerdmans, 2001).
20. Whitehead, p. 4.
21. Alvin Plantinga, *Warrant and Proper Function* (New York: Oxford University Press, 1993), p. 218.
22. Roger Trigg, *Philosophy Matters* (Oxford: Blackwell, 2002), p. 83.
23. Cited in Plantinga, p. 218, emphasis in original.
24. Richard Rorty, "Untruth and Consequences," *The New Republic* (July 31, 1995), p. 38.
25. Francis Darwin, ed., *Life and Letters of Charles Darwin* (New York: D. Appleton and Co., 1898), Vol. I, p. 285. For several such quotations from Darwin, see Nancy Pearcey, "The Influence of Evolution on Philosophy and Ethics," *Science at the Crossroads* (Richfield, MN: Onesimus Publishing, 1985), pp. 166-171.
26. Trigg, p. 99.
27. Review available at http://id-www.ucsb.edu/fscf/library/plantinga/dennett.html.